The documentation and process conversion measures necessary to comply with this document shall be completed by 20 January 2014.

INCH-POUND

MIL-PRF-19500/605D
20 November 2013
SUPERSEDING
MIL-PRF-19500/605C
16 April 2008

PERFORMANCE SPECIFICATION SHEET

SEMICONDUCTOR DEVICE, FIELD EFFECT RADIATION HARDENED (TOTAL DOSE ONLY)
TRANSISTORS, N-CHANNEL, SILICON, TYPES 2N7292, 2N7294, 2N7296, AND 2N7298,
JANTXVM, D, R, H AND JANSM, D AND R

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product described herein shall consist of this specification sheet and MIL-PRF-19500.

1. SCOPE

1.1 Scope. This specification covers the performance requirements for an N-Channel, enhancement-mode, MOSFET, radiation hardened (total dose only), power transistor intended for use in high density power switching applications. Two levels of product assurance are provided for each device type specified in MIL-PRF-19500.

1.2 Physical dimensions. See figure 1 (similar to TO-254).

1.3 Maximum ratings (T_C = +25°C, unless otherwise specified).

Type	P_T (1) T_C = +25°C	P_T T_A = +25°C	V_{DS}	V_{DG}	V_{GS}	I_{D1} (2) T_C = +25°C	I_{D2} (2) T_C = +100°C	I_S (2)	I_{DM} (3)	T_J and T_{STG}	V_{ISO} 70,000 feet altitude
	W	W	V dc	V dc	A dc	A dc	A dc	A dc	A(pk)	°C	V dc
2N7292	125	2.5	100	100	±20	25	20	25	75	-55 to +150	N/A
2N7294	125	2.5	200	200	±20	23	15	23	69	-55 to +150	N/A
2N7296	125	2.5	250	250	±20	17	11	17	51	-55 to +150	250
2N7298	125	2.5	500	500	±20	9	6	9	27	-55 to +150	500

(1) Derate linearly 1.0 W/°C for T_C > +25°C.
(2) The following formula derives the maximum theoretical I_D limit. I_D is limited by package and internal wires and may be limited by pin diameter:

$$I_D = \sqrt{\frac{T_{JM} - T_C}{(R_{\theta JC}) \times (R_{DS}(on) \text{ at } T_{JM})}}$$

(3) I_{DM} = 4 x I_D as calculated by note (2).

* Comments, suggestions, or questions on this document should be addressed to DLA Land and Maritime, ATTN: VAC, P.O. Box 3990, Columbus, OH 43218-3990, or emailed to Semiconductor@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at https://assist.dla.mil/.

1.4 Primary electrical characteristics at T_C = +25°C.

Type	Min $V_{(BR)DSS}$ V_{GS} = 0 I_D = 1.0 mA dc	$V_{GS(th)1}$ $V_{DS} \geq V_{GS}$ I_D = .250 mA dc		Max I_{DSS1} V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS}	Max $r_{DS(on)}$ V_{GS} = 10 V dc (1)		$R_{\theta JC}$ max (2)	$I_{AS} = I_{DM}$	E_{AS} at I_{AS}
		V dc			T_J = +25°C at I_{D2}	T_J = +125°C at I_{D2}			
	V dc	Min	Max	μA dc	Ω	Ω	°C/W	A(pk)	mJ
2N7292	100	2	4	25	0.070	0.140	1.00	75	281
2N7294	200	2	4	25	0.115	0.253	1.00	69	238
2N7296	250	2	4	25	0.185	0.444	1.00	51	130
2N7298	500	2	4	25	0.615	1.60	1.00	27	36

(1) Pulsed (see 4.5.1).
(2) See figure 2 thermal impedance curves.

2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATIONS

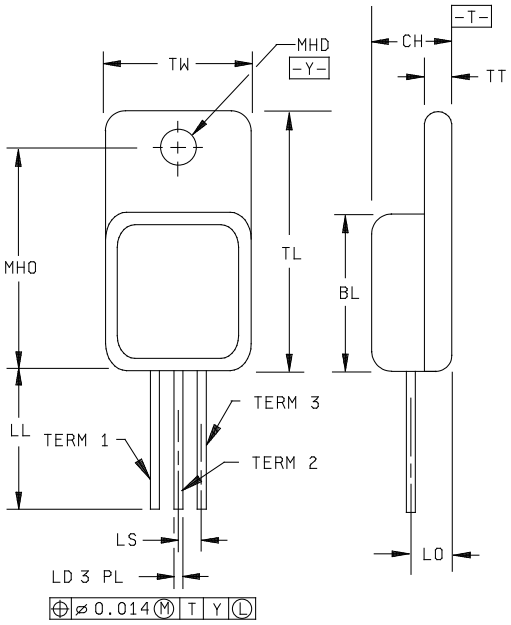
MIL-PRF-19500 - Semiconductor Devices, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-750 - Test Methods for Semiconductor Devices.

* (Copies of these documents are available online at http://quicksearch.dla.mil/ or https://assist.dla.mil/ or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.3 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.



Ltr	Dimensions				Notes
	Inches		Millimeters		
	Min	Max	Min	Max	
BL	.530	.550	13.46	13.97	
CH	.249	.260	6.32	6.60	
LD	.035	.045	0.89	1.14	
LL	.520	.560	13.21	14.22	
LO	.150 BSC		3.81 BSC		
LS	.150 TYP		3.81 TYP		
MHD	.139	.149	3.53	3.78	
MHO	.665	.685	16.89	17.40	
TL	.790	.800	20.07	20.32	3, 4
TT	.040	.050	1.02	1.27	3, 4
TW	.535	.545	13.59	13.84	
Term 1	Drain				
Term 2	Source				
Term 3	Gate				

NOTES:
1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. All terminals are isolated from case.
4. The preferred measurements used herein are the metric units. However, this transistor was designed using inch-pound units of measurement. In case of conflicts between the metric and inch-pound units, the inch-pound units shall be the rule.
5. In accordance with ASME Y14.5M, diameters are equivalent to ϕx symbology.
6. Die to base is BeO isolated, terminals to case ceramic (AL_2O_3) isolated.

FIGURE 1. Physical dimensions for TO-254AA (2N7292, 2N7294, 2N7296, and 2N7298).

3. REQUIREMENTS

3.1 General. The individual item requirements shall be as specified in MIL-PRF-19500 and as modified herein.

3.2 Qualification. Devices furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturer's list (QML) before contract award (see 4.2 and 6.3).

3.3 Abbreviations, symbols, and definitions. Abbreviations, symbols, and definitions used herein shall be as specified in MIL-PRF-19500 and as follows: I_{AS} - Rated avalanche current, non-repetitive.

3.4 Interface and physical dimensions. The interface and physical dimensions shall be as specified in MIL-PRF-19500, and figure 1 (TO-254AA) herein.

3.4.1 Lead material and finish. Lead material shall be Kovar or Alloy 52; a copper core or plated core is permitted. Lead finish shall be solderable as defined in MIL-PRF-19500, MIL-STD-750, and herein. Where a choice of lead finish is desired, it shall be specified in the acquisition documents (see 6.2).

3.4.2 Internal construction. Multiple chip construction is not permitted to meet the requirements of this specification.

3.5 Marking. Marking shall be in accordance with MIL-PRF-19500. At the option of the manufacturer, marking of the country of origin may be omitted from the body of the transistor, but shall be retained on the initial container.

3.6 Electrostatic discharge protection. The devices covered by this specification require electrostatic discharge protection.

3.6.1 Handling. MOS devices must be handled with certain precautions to avoid damage due to the accumulation of static charge. However, the following handling practices are recommended (see 3.6).

a. Devices should be handled on benches with conductive handling devices.

b. Ground test equipment, tools, and personnel handling devices.

c. Do not handle devices by the leads.

d. Store devices in conductive foam or carriers.

e. Avoid use of plastic, rubber, or silk in MOS areas.

f. Maintain relative humidity above 50 percent if practical.

g. Care should be exercised during test and troubleshooting to apply not more than maximum rated voltage to any lead.

h. Gate must be terminated to source, $R \leq 100\ k\Omega$, whenever bias voltage is to be applied drain to source.

3.7 Electrical performance characteristics. Unless otherwise specified herein, the electrical performance characteristics are as specified in 1.3, 1.4, and table I.

3.8 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table I.

3.9 Workmanship. Semiconductor devices shall be processed in such a manner as to be uniform in quality and shall be free from other defects that will affect life, serviceability, or appearance.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Qualification inspection (see 4.2).

b. Screening (see 4.3).

c. Conformance inspection (see 4.4 and tables I and II).

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-19500, and as specified herein. Alternate flow is allowed for qualification inspection in accordance with MIL-PRF-19500.

4.2.1 Group E qualification. Group E inspection shall be performed for qualification or re-qualification only. In case qualification was awarded to a prior revision of the associated specification that did not request the performance of table III tests, the tests specified in table III herein shall be performed by the first inspection lot of this revision to maintain qualification.

* 4.3 Screening (JANS and JANTXV levels). Screening shall be in accordance with table E-IV of MIL-PRF-19500, and as specified herein. The following measurements shall be made in accordance with table I herein. Devices that exceed the limits of table I herein shall not be acceptable.

Screen (see table E-IV of MIL-PRF-19500) (1) (2)	Measurement	
	JANS level	JANTXV level
(3)	Gate stress test (see 4.3.1)	Gate stress test (see 4.3.1)
(3)	E_{AS} test, method 3470 of MIL-STD-750 (see 4.3.2)	E_{AS} test, method 3470 of MIL-STD-750 (see 4.3.2)
(3) 3c	V_{SD} test, method 3161 of MIL-STD-750 (see 4.3.3)	V_{SD} test, method 3161 of MIL-STD-750 (see 4.3.3)
(4)	Subgroup 2 of table I herein	Subgroup 2 of table I herein
9	I_{GSSF1}, I_{GSSR1}, I_{DSS1}	Not applicable
10	Method 1042 of MIL-STD-750, test condition B	Method 1042 of MIL-STD-750, test condition B
11	I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $R_{DS(on)1}$, $V_{GS(th)1}$ Subgroup 2 of table I herein. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{DSS1} = ±25 μA dc or ±100 percent of initial value, whichever is greater.	I_{GSSF1}, I_{GSSR1}, I_{DSS1}, $r_{DS(on)1}$, $V_{GS(th)1}$ Subgroup 2 of table I herein.
12	Method 1042 of MIL-STD-750, test condition A	Method 1042 of MIL-STD-750, test condition A or T_A = +175°C and t = 48 hours min (5)
13	Subgroup 2 and 3 of table I herein. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater ΔI_{DSS1} = ±25 μA dc or ±100 percent of initial value, whichever is greater $\Delta R_{DS(on)1}$ = ±20 percent of initial value. $\Delta V_{GS(th)1}$ = ±20 percent of initial value.	Subgroup 2 and 3 of table I herein. ΔI_{GSSF1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{GSSR1} = ±20 nA dc or ±100 percent of initial value, whichever is greater. ΔI_{DSS1} = ±25 μA dc or ±100 percent of initial value, whichever is greater. $\Delta R_{DS(on)1}$ = ±20 percent of initial value. $\Delta V_{GS(th)1}$ = ±20 percent of initial value.
* 17	For TO-254AA packages: Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.	For TO-254AA packages: Method 1081 of MIL-STD-750 (see 4.3.4), Endpoints: Subgroup 2 of table I herein.

(1) At the end of the test program, I_{GSSF1}, I_{GSSR1} and I_{DSS1} are measured.
(2) An out-of-family program to characterize I_{GSSF1}, I_{GSSR1}, I_{DSS1} and $V_{GS(th)1}$ shall be invoked.
(3) Shall be performed any time before screen 9.
(4) Shall be performed after V_{SD} test, E_{AS} test, and gate stress test.
(5) Use of this accelerated screening option requires a 1,000-hour life test in accordance with applicable group E, subgroup 2 life test, and end-points specified herein to be provided to the qualifying activity for review and acceptance.

4.3.1 Gate stress test. Apply V_{GS} = 30 V minimum for t = 250 μs minimum.

4.3.2 Single pulse avalanche energy (E_{AS}).

a. $I_{AS} = I_{DM}$.

b. L = .1 mH.

c. $E_{AS} = 1/2\ LI_{AS}^2$.

d. Initial junction temperature = +25°C, +10°C, -5°C.

4.3.3 Thermal impedance. The thermal impedance measurements shall be performed in accordance with method 3161 of MIL-STD-750 using the guidelines in that method for determining I_M, I_H, t_H, t_{SW}, (and V_H where appropriate). Measurement delay time (t_{MD}) = 70 μs max. See table III, group E, subgroup 4 herein.

* 4.3.4 Dielectric withstanding voltage.

a. Magnititude of test voltage……..900 V dc.

b. Duration of application of test voltage……..15 seconds (min).

c. Points of application of test voltage……..All leads to case (bunch connection).

d. Method of connection……..Mechanical.

e. Kilovolt-ampere rating of high voltage source…….1,200 V/1.0 mA (min).

f. Maximum leakage current……...1.0 mA.

g. Voltage ramp up time.....500 V/second.

4.4 Conformance inspection. Conformance inspection shall be in accordance with MIL-PRF-19500, and as specified herein.

4.4.1 Group A inspection. Group A inspection shall be conducted in accordance with MIL-PRF-19500 and table I herein. (End-point electrical measurements shall be in accordance table I, subgroup 2 herein.)

4.4.2 Group B inspection. Group B inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VIA (JANS) and table E-VIB (JANTXV) of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.4.2.1 Group B inspection, table E-VIA (JANS) of MIL-PRF-19500.

Subgroup	Method	Condition
B3	1051	Condition G, 100 cycles.
B4	1042	Condition D. No heat sink or forced air cooling on the device shall be permitted during the on cycle. t_{on} = 30 seconds minimum.
B5	1042	Condition A; V_{DS} = 100 percent of rated; T_A = +175°C, t = 120 hours, or T_A = +150°C, t = 120 hours minimum. Read and record $V_{BR(DSS)}$ (pre and post) at I_D = 1 mA; Read and record I_{DSS} (pre and post) in accordance with table I, subgroup 2.
B5	1042	Condition B; V_{GS} = 100 percent of rated; T_A = +175°C; t = 24 hours minimum.

4.4.2.2 Group B inspection, table E-VIB (JANTXV) of MIL-PRF-19500.

Subgroup	Method	Condition
B2	1051	Test condition G, 25 cycles.
B3	1042	The heating cycle shall be 30 seconds minute minimum.
B5		Not applicable.
B6		Not applicable.

4.4.3 Group C inspection. Group C inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-VII of MIL-PRF-19500, and as follows. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

Subgroup	Method	Condition
C2	2036	Terminal strength, test condition A, weight = 10 lbs., t = 15 sec.
C5	3161	See 4.5.2, $R_{\theta JC(max)}$ = 1.00°C/W.
C6	1042	Test condition D; 1 cycle = 30 sec. min.

4.4.4 Group D Inspection. Group D inspection shall be conducted in accordance with table E-VIII of MIL-PRF-19500 and table II herein.

4.4.5 Group E inspection. Group E inspection shall be conducted in accordance with the conditions specified for subgroup testing in table E-IX of MIL-PRF-19500 and as specified herein. Electrical measurements (end-points) shall be in accordance with table I, subgroup 2 herein.

4.5 Methods of inspection. Methods of inspection shall be as specified in appropriate tables and as follows.

4.5.1 Pulse measurements. Conditions for pulse measurement shall be as specified in section 4 of MIL-STD-750.

4.5.2 Thermal resistance. The thermal resistance measurements shall be performed in accordance with method 3161 of MIL-STD-750 using the guidelines in that method for determining I_M, I_H, t_H, t_{SW} (and V_H where appropriate). Measurement delay time (t_{MD}) = 70 μs max. See table E-IX of MIL-PRF-19500, group E, Subgroup 4.

TABLE I. Group A inspection.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 1						
Visual and mechanical inspection	2071					
Subgroup 2						
Thermal Impedance 2/	3161	See 4.3.3	$Z_{\theta JX}$			°C/W
Breakdown voltage, drain to source	3407	Bias condition C, V_{GS} = 0V, I_D = 1 mA dc	$V_{(BR)DSS}$			
2N7292				100		V dc
2N7294				200		V dc
2N7296				250		V dc
2N7298				500		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA	$V_{GS(th)1}$	2.0	4.0	V dc
Gate current	3411	Bias condition C, V_{GS} = +20 V dc, V_{DS} = 0 V dc	I_{GSSF1}		+100	nA dc
Gate current	3411	Bias condition C, V_{GS} = -20 V dc, V_{DS} = 0 V dc	I_{GSSR1}		-100	nA dc
Drain current	3413	Bias condition C, V_{GS} = 0 V dc, V_{DS} = 80 percent of rated V_{DS}	I_{DSS1}		25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = 10 V dc, condition A, pulsed (see 4.5.1), I_D = rated I_{D2}	$r_{DS(on)1}$			
2N7292					0.070	Ω
2N7294					0.115	Ω
2N7296					0.185	Ω
2N7298					0.615	Ω
Static drain to source on-state resistance	3421	V_{GS} = 10 V dc, condition A, pulsed (see 4.5.1), I_D = rated I_{D1}	$r_{DS(on)2}$			
2N7292					0.074	Ω
2N7294					0.121	Ω
2N7296					0.194	Ω
2N7298					0.646	Ω
Forward voltage	4011	V_{GS} = 0 V dc, I_D = rated I_{D1}, pulsed (see 4.5.1)	V_{SD}		1.8	V

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 3						
High temperature operation:		$T_C = T_J = +125°C$				
Gate current	3411	Bias condition C, V_{GS} = +20 and -20 V dc, V_{DS} = 0 V dc,	I_{GSS2}		±200	nA dc
Drain current	3413	Bias condition C, V_{GS} = 0 V dc, V_{DS} = 100 percent of rated V_{DS}	I_{DSS2}		1.0	mA dc
Drain current	3413	Bias condition C, V_{GS} = 0 V dc, V_{DS} = 80 percent of rated V_{DS}	I_{DSS3}		0.25	mA dc
Static drain to source on-state resistance	3421	Condition A. V_{GS} = 10 V dc, pulsed (see 4.5.1), I_D = rated I_{D2}	$r_{DS(on)3}$			
2N7292					0.140	Ω
2N7294					0.253	Ω
2N7296					0.444	Ω
2N7298					1.60	Ω
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 1 mA	$V_{GS(th)2}$	1.0		V dc
Low temperature operation:		$T_C = T_J = -55°C$				
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$, I_D = 0.25 mA	$V_{GS(th)3}$		5.0	V dc

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 4						
Switching time test	3472	$I_D = I_{D1}$, V_{GS} = 10 V dc, R_G = 25 Ω, V_{DD} = 50 percent of V_{DS}				
Turn-on delay time			$t_{d(on)}$			
2N7292					134	ns
2N7294					156	ns
2N7296					114	ns
2N7298					148	ns
Rise time			t_r			
2N7292					628	ns
2N7294					510	ns
2N7296					162	ns
2N7298					196	ns
Turn-off delay time			$t_{d(off)}$			
2N7292					642	ns
2N7294					574	ns
2N7296					990	ns
2N7298					800	ns
Fall time			t_f			
2N7292					490	ns
2N7294					280	ns
2N7296					256	ns
2N7298					180	ns
Subgroup 5						
Safe operating area test	3474	See figure 3, t_p = 10 ms, V_{DS} = 80 percent of max rated V_{DS}, ($V_{DS} \leq$ 200 V)				
Electrical measurements		See table I, subgroup 2 herein				
Subgroup 6						
Not applicable						

See footnotes at end of table.

TABLE I. Group A inspection - Continued.

Inspection 1/	MIL-STD-750		Symbol	Limits		Unit
	Method	Condition		Min	Max	
Subgroup 7						
Gate charge	3471	Condition B				
On-state gate charge			$Q_{g(on)}$			
2N7292					314	nC
2N7294					298	nC
2N7296					264	nC
2N7298					264	nC
Gate to source charge			Q_{gs}			
2N7292					46	nC
2N7294					66	nC
2N7296					48	nC
2N7298					56	nC
Gate to drain charge			Q_{gd}			
2N7292					164	nC
2N7294					144	nC
2N7296					124	nC
2N7298					126	nC
Reverse recovery time	3473	Condition A. $d_i/d_t \leq 100$ A/µs, $V_{DD} \leq 30$ V, $I_D = I_{D1}$, (see 1.3)	t_{rr}			
2N7292					1400	ns
2N7294					1700	ns
2N7296					2000	ns
2N7298					2300	ns

1/ For sampling plan, see MIL-PRF-19500.
2/ This test is required for the following end-point measurement only (not intended for screen 9, 11, or 13): JANS, table E-VIA of MIL-PRF-19500, group B, subgroups 3 and 4; JANTXV, table E-VIB of MIL-PRF-19500, group B, subgroups 2 and 3; and table E-VII of MIL-PRF-19500, group C, subgroup 6, and table E-IX of MIL-PRF-19500, group E, subgroup 1.

TABLE II. Group D inspection.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Unit
	Method	Conditions		R		R		
				Min	Max	Min	Max	
Subgroup 1								
Not applicable								
Subgroup 2		T_C = +25°C						
Steady-state total dose irradiation	1019	2/, 3/						
End-point electricals:								
Breakdown voltage, drain to source	3407	Bias condition C V_{GS} = 0, I_D = 1 mA	$V_{(BR)DSS}$					
2N7292				100		100		V dc
2N7294				200		200		V dc
2N7296				250		250		V dc
2N7298				500		500		V dc
Gate to source voltage (threshold)	3403	$V_{DS} \geq V_{GS}$	V_{GSth1}	2.0	4.0	2.0	4.0	V dc
Gate current	3411	Bias condition C V_{GS} = 20 V V_{DS} = 0	I_{GSSF1}		100		100	nA dc
Gate current	3411	Bias condition C V_{GS} = -20 V V_{DS} = 0	I_{GSSR1}		-100		-100	nA dc
Drain current	3413	Bias condition C V_{GS} = 0 V_{DS} = 80 percent of rated V_{DS} (pre-irradiation)	I_{DSS1}		25		25	µA dc
Static drain to source on-state resistance	3421	V_{GS} = 10 V, condition A pulsed (see 4.5.1) I_D= I_{D2}	R_{DSon1}					
2N7292				0.070		0.070		Ω
2N7294				0.115		0.115		Ω
2N7296				0.185		0.185		Ω
2N7298				0.615		0.615		Ω

See footnotes at end of table.

TABLE II. Group D inspection - Continued.

Inspection 1/ 2/ 3/	MIL-STD-750		Symbol	Preirradiation limits		Postirradiation limits		Unit
	Method	Conditions		R		R		
				Min	Max	Min	Max	
Drain to source on state voltage	3405	V_{GS} = 10 V condition A pulsed (see 4.5.1) $I_D = I_{D1}$	V_{DSon}					
2N7292					1.84		1.84	V dc
2N7294					2.78		2.78	V dc
2N7296					3.30		3.30	V dc
2N7298					5.81		5.81	V dc

1/ For sampling plan see MIL-PRF-19500.
2/ Inspection requires all subgroup 2 (group D) measurements after exposure to both of the following insitu bias conditions:
   a. V_{GS} = 10 V; V_{DS} = 0
   b. V_{GS} = 0 V; V_{DS} = 80 percent of rated V_{DS}
3/ Each bias condition requires a separate total dose sample.

TABLE III. Group E inspection (all quality levels) for qualification or requalification only.

Inspection	MIL-STD-750		Sampling plan
	Method	Conditions	
Subgroup 1			45 devices c = 0
Temperature cycling	1051	-55 to 150°C, 500 cycles.	
Hermetic seal	1071		
Fine leak Gross leak			
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 2 1/			45 devices c = 0
Steady-state reverse bias	1042	Condition A, 1,000 hours.	
Electrical measurements		See table I, subgroup 2 herein.	
Steady-state gate bias	1042	Condition B, 1,000 hours.	
Electrical measurements		See table I, subgroup 2 herein.	
Subgroup 4			Sample size N/A
Thermal impedance curves		See MIL-PRF-19500.	
Subgroup 5 2/			5 devices c = 0
Barometric pressure test 2N7296 2N7298	1001	Condition C, $V_{(ISO)} = V_{DS}$ V_{DS} = 250 V dc V_{DS} = 500 V dc	
Subgroup 10			45 devices, c = 0
Commutating diode for safe operating area test procedure for measuring dv/dt during reverse recovery of power MOSFET transistors or insulated gate bipolar transistors	3476	Test conditions shall be derived by the manufacturer	

1/ A separate sample for each test shall be pulled.
2/ Not required for 2N7292, 2N7294.

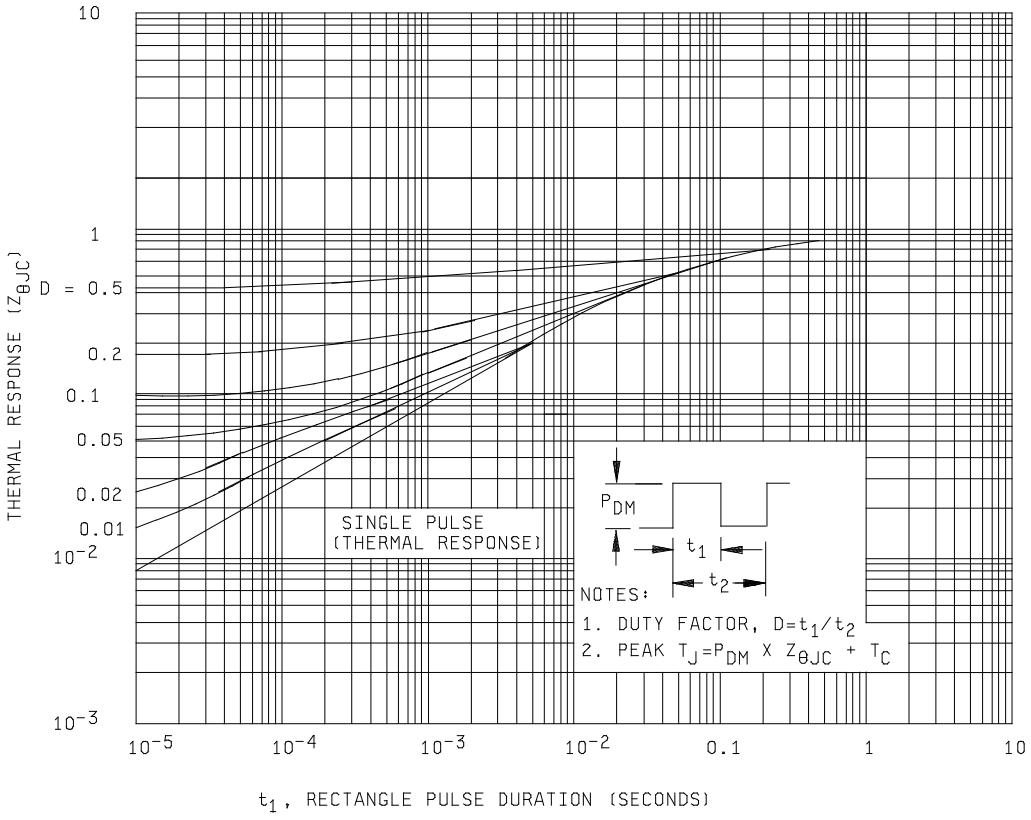


FIGURE 2. Thermal response curves.

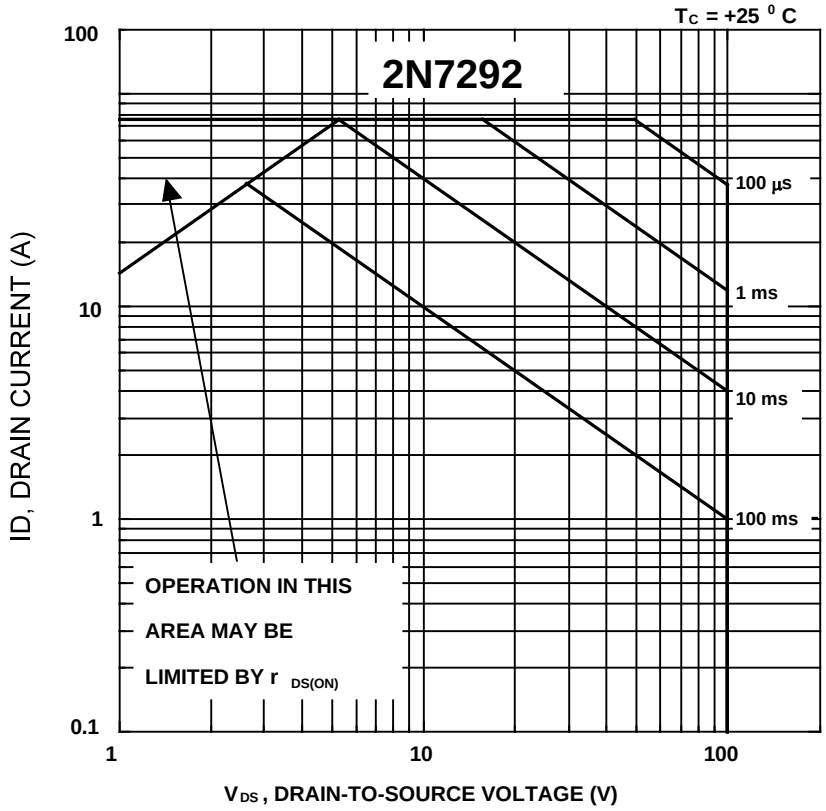


FIGURE 3. Safe operating area graphs.

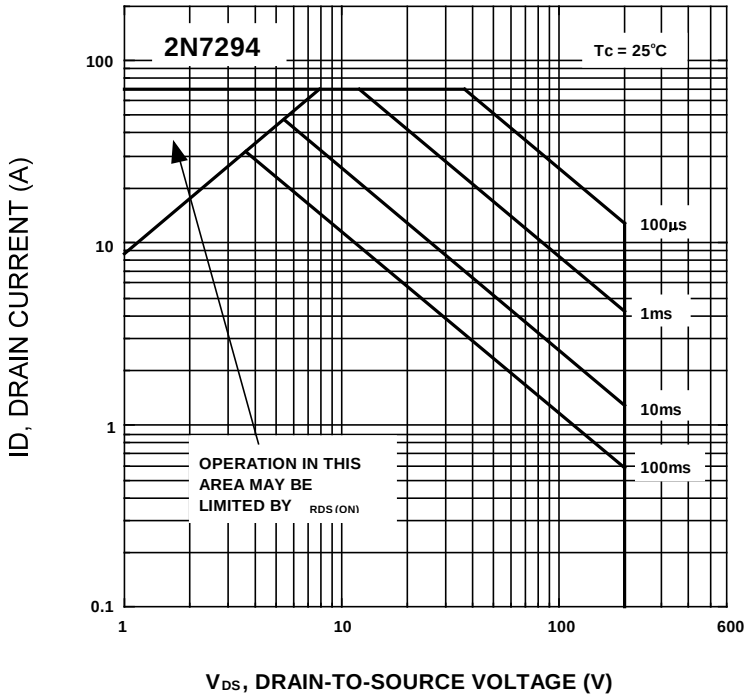


FIGURE 3. Safe operating area graphs - Continued.

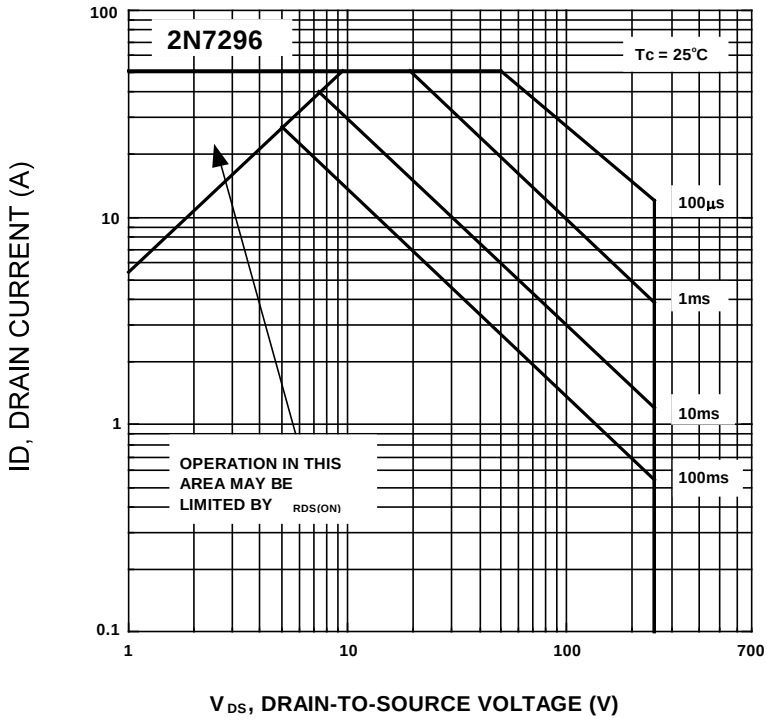


FIGURE 3. Safe operating area graphs - Continued.

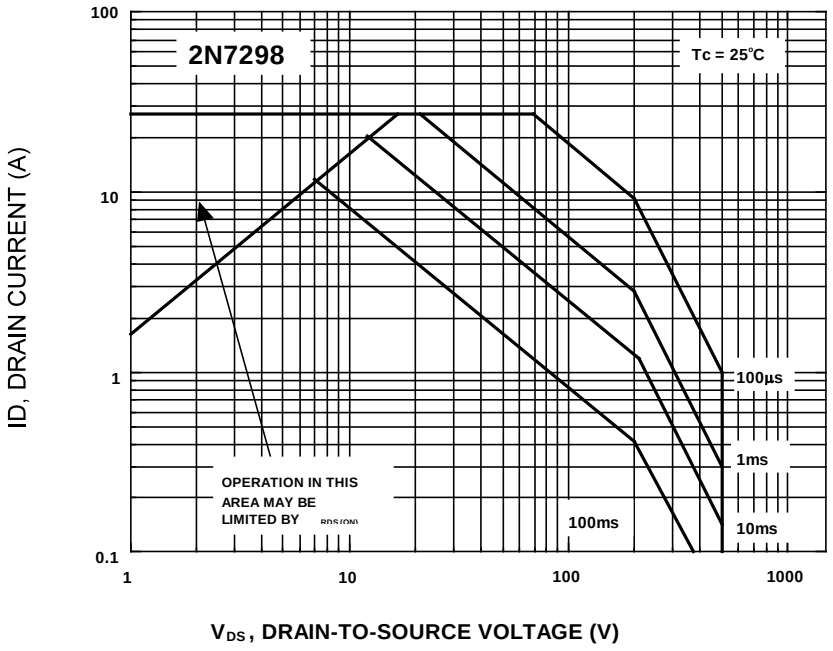


FIGURE 3. Safe operating area graphs - Continued.

5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activities within the Military Service or Defense Agency, or within the Military Service's system commands. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory. The notes specified in MIL-PRF-19500 are applicable to this specification.)

6.1 Intended use. Semiconductors conforming to this specification are intended for original equipment design applications and logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of this specification.

b. Packaging requirements (see 5.1).

c. Lead finish (see 3.4.1).

d. Product assurance level and type designator.

* 6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List (QML 19500) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DLA Land and Maritime, ATTN: VQE, P.O. Box 3990, Columbus, OH 43218-3990 or e-mail vqe.chief@dla.mil. An online listing of products qualified to this specification may be found in the Qualified Products Database (QPD) at https://assist.dla.mil.

6.4 Substitution information. Devices covered by this specification are substitutable for the manufacturer's and user's Part or Identifying Number (PIN). This information in no way implies that manufacturer's PIN's are suitable for the military PIN.

Preferred types	Commercial types
2N7292	FRF150 (1)
2N7294	FRF250 (1)
2N7296	FRF254 (1)
2N7298	FRF450 (1)

(1) FRFxxxM, FRFxxxD FRFxxxR, 3 k, 10 k, 100 k RAD(Si).

6.5 Changes from previous issue. The margins of this specification are marked with asterisks to indicate where changes from the previous issue were made. This was done as a convenience only and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content irrespective of the marginal notations and relationship to the last previous issue.

Custodians:
Army - CR
Navy - EC
Air Force - 85
NASA - NA
DLA - CC

Review activities:
Navy – AS, MC
Air Force - 19, 99

Preparing activity:
DLA - CC

(Project 5961-2013-112)

* NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at https://assist.dla.mil.